

Q 1

a) Identify the name of the following genetic engineering tool:

An enzyme derived from bacteria that recognizes a specific DNA sequence and cuts the DNA at that sequence.

b) Identify the name of the following genetic engineering tool:

An enzyme that can rejoin a broken bond in DNA.

Q 2

Define a vector and give two examples of vectors.

Q 3

Define probe.

Q 4

Define a transgenic animal (or plant)

Q 5

a) Define PCR.

b) Provide two examples where PCR would be useful.

Q 6

A pregnant mother would like to use prenatal screening to determine if her fetus has a gene mutation due to a deletion of two nucleotides.

Identify and describe three technologies that would be used to identify this mutation in her fetus.

A 2

A vector is a delivery system used to move foreign DNA into a cell

-Two types of vectors: plasmids and viruses

A 1

a) Restriction enzyme.

b) Ligase.

A 4

A transgenic organism is one that contains recombinant DNA: an organism whose genetic material includes DNA from a different species

A 3

A probe is a radioactively labeled nucleic acid molecule used to find a specific gene or nucleotide sequence

A 6

Technology #1

Ultrasound: Sound waves are bounced off soft tissue and the echoes produce an image of a fetus displayed on a screen. This screen image is helpful to locate the position of the fetus when withdrawing a tissue sample.

Technology #2

Amniocentesis: Withdrawal of amniotic fluid and fetal cells to analyze or CVS: Withdrawal and analysis of chorionic villi tissue

Technology #3

Gel electrophoresis: used to examine the deleted nucleotide sequence in the fetal DNA by separating fragments of DNA according to their mass and charge

A 5

a) PCR is a technique for amplifying a DNA sequence by repeated cycles of strand separation and replication

b) Used for any variety of tasks that require increasing the amount of DNA from an original small sample, such as DNA samples from a crime scene or DNA samples from ancient species

Q7

Explain why a karyotype can't be used to identify a gene mutation.

Q 8 A pregnant mother would like to use prenatal screening to determine if her fetus has a chromosomal abnormality, such as an extra chromosome on pair 21.

Identify and describe three technologies that would be used to identify chromosome mutations, such as changes in chromosome number in a fetus.

Q 9

- a) Describe gel electrophoresis
- b) What is this technology used for?

Q 10 The process of transformation uses genetic engineering to produce bacterial cells capable of synthesizing human growth hormone.

- a) **Identify and describe four technologies** that would be involved with this process.
- b) **Identify the name of the bacterial DNA** that has been transformed to incorporate human DNA.

Q 11

- a) **Identify and describe two technologies** that would be used in DNA fingerprinting.
- b) **Describe two instances** when DNA fingerprinting would be useful

Q 12

- a) **Identify a common DNA vector** used in gene therapy and **explain** why they are well-suited.
- b) Besides vectors, **identify and describe two technologies** that would be used in gene therapy.

A 8

Technology #1

Ultrasound: Sound waves are bounced off soft tissue and the echoes produce an image of a fetus displayed on a screen. This screen image is helpful to locate the position of the fetus when withdrawing a tissue sample.

Technology #2

Amniocentesis: Withdrawal of amniotic fluid and fetal cells to analyze or **CVS:** Withdrawal and analysis of chorionic villi tissue

Technology #3

Karyotype:

-Cell division is stimulated and then stopped at mitotic metaphase.

-Chromosomes are stained and photographed.

-The homologous chromosomes are paired and numbered.

A 7

A karyotype identifies chromosome mutations changes in chromosome number or structure; any changes involving a smaller section of the chromosome, such as a gene mutation, are not physically visible with a karyotype.

A 10

a) Technology #1

DNA probe: a radioactively labeled nucleic acid molecule used to find the hGH gene in a human cell

Technology #2

Restriction enzyme: cleaves the nucleotide sequence of both bacterial plasmid DNA and human DNA at the specific recognition site

Technology #3

Ligase: splices together the human DNA into the genome of the bacterial plasmid

Technology #4

Vector: bacterial plasmid is a vector that delivers the recombinant DNA into the bacterial cell

b) recombinant DNA

A 9

a) **Gel electrophoresis:** DNA fragments (or proteins) are applied to one end of a gel. An electric current is passed through the gel. The rate of migration through the gel depends upon the size and electrical charge of the molecule.

b) The patterns (DNA fingerprint) observed are used to determine the presence or absence of particular DNA segments (or proteins)

A 12

a) **Viruses** are well-suited to gene therapy because most have the ability to target certain types of living cells and to insert their DNA into the genomes of these cells

b)

Technology #1

restriction enzyme: used to cut out disease causing portion of viral vector

Technology #2

ligase: used to splice in working human gene into viral genome

A 11

a) A sample of DNA is cut with **restriction enzymes**—this produces a number of DNA segments of different lengths.

Because each individual has a unique DNA sequence (genome), each will have a different number of sites where the enzyme will cut. This results in a unique number and length of DNA segments for each individual. These DNA individual segments produce a unique banding pattern (“fingerprint”) when analyzed using **gel electrophoresis**.

b) Used to determine paternity and to provide evidence in forensic court cases. Used in many species to help establish kinship.